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ABSTRACT

A longitudinal study was conducted to determine the effect of teachers and achievement on the students valuing of mathematics. A total of 1,301 students and the teachers they had for mathematics before and after transition to junior high school were involved in the study. It was found that when students move from elementary teachers they percieve to be low in support to junior high teachers they perceive to be high in support, the intrinsic value of math is enhanced, while students who move from teachers they perceive to be high in support to teachers they perceive to be low in support experience a sharp decline in both intrinsic value and perceived usefulness and importance of math. Students' perceptions of the usefulness and importance of math interacts with achievement level. Math values decrease more sharply during the first year of junior high for low achieving students who move from more supportive to less supportive teachers than for high achieving students who experience the same change. (Author/TW)

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# Student/Teacher Relations and Attitudes toward Mathematics Before and After the Transition to Junior High School

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## Abstract

In a longitudinal study of 1301 students and the teachers they had for mathematics before and after the transition to junior high school, we assessed whether changes across the transition in students' perceptions of their teachers' supportiveness were related to changes in their valuing of mathematics.

Using repeated measures multivariate analysis of variance, we found that when students moved from elementary teachers they perceived to be low in support to junior high teachers they perceived to be high in support, the intrinsic value of math was enhanced; while students who moved from teachers they perceived to be high in support to teachers they perceived to be low in support experienced a sharp decline in both the intrinsic value and perceived usefulness and importance of math.

For students' perceptions of the usefulness and importance of math there was an interaction with achievement level. Math values decreased more sharply during the first year of junior high for low achieving students who moved from more supportive to less supportive teachers than for high achieving students who experienced the same change.

For a number of years educators and psychologists have expressed concern about the deterioration of students' achievement -related beliefs, values, and performance after the transition to junior high school and have speculated about the reasons for these negative shifts (e.g., Berndt & Hawkins, 1988; Eccles, Midgley, & Adler, 1984; Finger & Silverman, 1966; Lipsitz, 1977; 1980; Silberman, 1970; Simmons & Blyth, 1987; Sprinthall, 1985; Ward, Mergendoller, & Tikunoff, 1982). Some investigators have suggested that this is an inevitable age-related phenomenon associated with pubertal change and cognitive maturation. We have suggested that systematic changes in the classroom environment after the transition to middle or junior high school contribute to a decline in achievement-related attitudes, values, motives, and behavior for some children (Eccles & Midgley, in press; Eccles et al., 1984; Feldlaufer, Midgley, & Eccles, 1988; Midgley & Feldlaufer, 1987, Midgley, Feldlaufer, & Eccles, in press). This study seeks to determine if changes in students' perceptions of the student/teacher relationship during the transition to junior high school influence their valuing of mathematics.

In a recent longitudinal study, we found that student/teacher relationships deteriorated after the transition from elementary school to junior high school (Feldlaufer et al., 1988). In particular, students said that the teachers they had for mathematics after the transition to junior high school cared less about them, were less friendly, and graded them less fairly than the teachers they had for mathematics the last year of elementary school. Classroom observations confirmed this pattern. Observers reported that seventh grade junior high school math teachers were less warm and supportive than sixth grade elementary school teachers. In other studies of the transition from elementary school to middle, junior high, or high school, students reported less favorable interpersonal relations with their teachers after the transition than before (Hawkins & Berndt, 1985; Hirsch & Rapkin, 1987; O'Connor, 1978; Trebilco, Atkinson, & Atkinson, 1977). This shift in the quality of student/teacher relationships may contribute to a decline in students' academic motivation.

Research on the effects of classroom climate indicates that the quality of student/teacher relationships is associated with students' academic motivation and attitudes toward school (e.g., Fraser & Fisher, 1982; Hartmut, 1978; Berndt & Hawkins, 1988; Moos, 1979; Trickett & Moos, 1974). Several of these investigators used the Teacher Support subscale of the Classroom Environment Scale (CES) (Moos & Trickett, 1974) to assess the student/teacher relationship. For example,Trickett and Moos (1974) found a strong, consistent association between teacher support and high school students' academic interest and feelings of satisfaction and security. Fraser and Fisher (1982) found positive correlations between both teacher support, measured by the CES, and personalization,

measured by the Individualized Classroom Environment Questionnaire, and junior high school students' enjoyment of science lessons. Similarly, teacher supportiveness was related to students' academic adjustment both before and after the transition to junior high school in a study by Berndt and Hawkins (1988). Finally, using a different measure of the student/teacher relationship, Hartmut (1978), in a large study of grades 5-9 in Germany, found that teachers who were observed to have more supportive qualities had pupils who were more motivated and less anxious. Given these associations, changes in the student/teacher relationship may induce changes in students' academic motivation.

Some groups of students may be affected more than others by the quality of their relationship with their teachers. Recent data gathered by Veroff suggests that adolescent girls have a greater need than boys for affiliation and social connectedness (e.g., Veroff, 1983) and may therefore be more sensitive to teacher support or the lack of it in the classroom. In addition, high and low achieving students may be affected differentially by the nature of the student/teacher relationship. High achieving students, because they are performing well, may be able to sustain their motivation and continue to value academics even though they have teachers who are perceived to be less supportive than the teachers they had previously. On the other hand, low achieving students, because their performance does not provide an incentive, may be particularly sensitive to the characteristics of their teachers. In support of this suggestion, we found that differences in teachers' sense of efficacy before and after the transition to junior high school had a much stronger impact on changes in low achieving students' self and task perceptions in mathematics than on changes in higher achieving students' perceptions (Midgley et al., 1988).

This study focuses on the effect of differences in the perceived student/teacher relationship before and after the transition to junior high school on changes in the value students attach to mathematics. We consider student perceptions of teacher support to be a strong indicator of the subjective quality of the student/teacher relationship. We predict that for students who perceive little change in teacher supportiveness before and after the transition, there will be relatively little change in the intrinsic valuing of math and in their perceptions of the importance and usefulness of math (math value) over the two years. In contrast, we predict that the value of math for students who move from teachers they perceive to be more supportive to teachers they perceive to be less supportive will decline, and the value of math for students who move from teachers they perceive to be low in support to teachers they perceive to be high support will increase. In addition, we predict that the effect of differences in perceived teacher support before and after the transition on student valuing of math will be stronger for girls than for boys and stronger for low achieving than high achieving students.

## Method

The data reported here were collected as part of a two year, four wave panel study (The Transitions at Early Adolescence Project) investigating the impact of changes in classroom and family environments on early adolescents' motives, beliefs, values, and behaviors. Analyses reported here include data collected at all four waves of the study (fall and spring of the 1983/84 school year and fall and spring of the 1984/85 school year).

### SAMPLE

Twelve school districts located in middle-income communities in southeastern Michigan were recruited for this project. The school districts are located near a major metropolitan area in the Midwest and serve middle-income communities. Almost 90% of the students in these districts are Caucasian. All teachers in those districts who taught mathematics to fifth or sixth graders scheduled to make a transition the next year to middle or junior high school were recruited year one: 95% of the teachers, representing 143 classrooms, agreed to participate. Students were followed year two into 171 mathematics classrooms. All eligible year two teachers agreed to participate. Students participated on a voluntary basis. Of the eligible students, 79% agreed to participate. A student attrition rate of 14% between years one and two was accounted for largely by students who moved out of participating school districts. A total of 2501 students filled out questionnaires at all four waves.

#### *Case Selection*

A subset of the student sample from the Transitions project is used in the analyses reported here. The sample consists of 1301 students who made a transition from a sixth grade elementary school classroom to a seventh grade junior high school classroom, had the same teacher for math both semesters each year, and completed the Michigan Educational Assessment Test (MEAP) in the seventh grade.[1]

### PROCEDURES

Questionnaires, measuring a large number of theoretical constructs across multiple activity domains, were administered by field staff to students during the period they normally received mathematics instruction for two consecutive days in the fall (waves 1 and 3) and spring (waves 2 and 4) of each school year.

### MEASURES

#### *Student Perceptions of the Value of Mathematics*

The dependent variables in this study are scales measuring students' perceptions of the intrinsic value of math and the importance and usefulness of math (see Appendix) and were developed by Parsons (1980). Extensive exploratory and confirmatory factor analyses support the discriminant validity of these scales (see Eccles, Adler, Futterman,

Goff, Kaczala, Meece, & Midgley, 1983; Eccles, Adler, & Meece, 1984; Reuman, 1986). Each scale contains four items scored on a 7-point Likert-type scale, with the exception of one item on the intrinsic value scale which has only two options. Scales were created by taking the mean of the items defining each composite. Cronbach's alpha reliability coefficients were computed for each composite and are .76 for the intrinsic value scale and .80 for the perceived importance/usefulness scale. The wording of items in each of these scales can be found in the Appendix.

*Student/Teacher Relationship*

The scale measuring student perceptions of the quality of the student/teacher relationship (Teacher Support) is one of five scales developed from items in the questionnaire that assess student perceptions of the classroom environment. These scales were developed on the basis of factor analysis and were constructed by taking the mean of the items defining each composite.[2] Items ask for information at a global level rather than at an individual level (for example, "The teacher is friendly to us" rather than "The teacher is friendly to me" and "The teacher treats some kids better than other kids" rather than "The teacher treats some kids better than me"). In this regard our Teacher Support scale is similar to the Teacher Support subscale of Moos' Classroom Environment Scale (Moos & Trickett, 1974). Our scale contains six items scored on a 4-point Likert-type scale (high scores = low support). The wording of items in this scale can be found in the Appendix. We named the scale "Teacher Support" because the items tap students' perceptions of their teachers' caring, friendliness, and fairness. Internal consistency, using Cronbach's coefficient of alpha, is .73.

In order to assess change in the quality of the student/teacher relationship after the transition to junior high school, students were divided into four groups based on their means on the Teacher Support scale at waves 2 and 4.[3]

*Student Achievement in Mathematics*

During the fall of 1984, all seventh grade students were administered the Michigan Educational Assessment Program (MEAP) as part of a statewide testing program in reading and mathematics. This test consists of sets of items measuring selected minimum performance objectives. In mathematics, each of 28 objectives are measure by a set of three items. The objective is attained if at least two of the three items are answered correctly. In addition to a raw score based on the number of objectives attained, a "category of achievement" ranking from one to four is given each test . We have grouped the students in this study into one of two achievement levels - high or low, based on their category of achievement on the MEAP. Approximately 75% of the sample fall into categories two, three, and four. These students attained 3/4 or more of the math objectives

(22-28 objectives) and are considered "high" achieving students in this study. Category one is the lowest ranking and is given to students who attained less than 3/4 of the math objectives (0-21). These students are categorized as "low" achievers in this study. Since this test assesses only minimal performance objectives and does not discriminate well among those achieving at the high end, we felt that this 75%/25% split based on the MEAP category of achievement would allow us to identify the truly low achievers whom we believe will be most affected by changes in their relationship with their teachers.

**Results**

Repeated measures multivariate analysis of variance (MANOVA) was used to test the effects of semester (fall versus spring), school year (sixth versus seventh grade), and the interaction of semester and school year for each of the dependent measures. In analyses assessing semester effects, waves 1 and 3 were compared to waves 2 and 4; year effects were based on comparisons of waves 1 and 2 to waves 3 and 4; and the interaction of semester and year compared the rate of change in year one with the rate of change in year two. Student perceptions of the intrinsic value of math (INT), and the importance and usefulness of math (USE) served as the dependent variables. Change in perceived teacher support from year one to year two, student gender, and student achievement level were included as between subjects factors.

In terms of between-subjects main effects, students in the four perceived teacher support change groups differ significantly from each other in their valuing of math (INT, $F = 36.94$, $p < .0001$; USE, $F = 35.59$, $p < .0001$). In addition, high achieving students value math more than low achieving students (INT, $F = 10.19$, $p < .001$; USE, $F = 28.86$, $p < .0001$). There are no sex differences on either of the dependent variables. Turning to the within-subjects main effects, there are highly significant year effects and semester effects on both dependent variables, with students valuing math more in the elementary school than in the junior high school (INT, $F = 67.26$, $p < .0001$; USE, $F = 149.65$, $p < .0001$), and more during the first semester than the second semester (INT, $F = 50.71$, $p < .0001$; USE, $F = 37.33$, $p < .0001$). Table 1 gives the means and standard deviations on the dependent variables at each wave. There is also a significant year by semester effect for intrinsic value ($F = 4.17$, $p < .05$), indicating that the rate of change within the two years differs.

INSERT TABLE 1 ABOUT HERE

The major hypothesis of this study that changes in students' valuing of mathematics are related to differences in perceived teacher support before and after the transition from elementary school to junior high school is confirmed. The two way interactions between

change in perceived teacher support and year changes in both dependent variables were highly significant (INT, $F = 21.80$, $p < .0001$; USE, $F = 16.41$, $p < .0001$). The nature of these relationships is shown in Table 1 and Figures 1 and 2. As predicted, students whose teachers are perceived to be high in support both years show very little change in their valuing of math across the transition. Both years the students in this group have the most positive perceptions of the value of math of any of the groups. Students who have teachers perceived to be low in support both years suffer a steady decline in their valuing of math across the two years and have the most negative perceptions of any of the groups. As predicted, moving from less supportive to more supportive teachers after the transition enhances the intrinsic value of math during the junior high school year. In contrast, students who move from more supportive teachers in elementary school to less supportive teachers in junior high school value math much more before than after the transition. For these students there is a sharp decline in both the intrinsic value of math and the perceived usefulness and importance of math during the junior high school year.

INSERT FIGURES 1 AND 2 ABOUT HERE

There is also a semester by change in perceived teacher support interaction for both dependent variables (INT, $F = 3.76$, $p < .05$; USE, $F = 5.47$, $p < .001$).. As can be seen in Figures 1 and 2, when students have a teacher perceived to be high in support, their perceptions of the intrinsic value and the usefulness/importance of math change very little from the first to the second semester. In contrast, when students have a teacher perceived to be low in support, their perceptions decline within the year.

Finally, there is a significant interaction of year, semester, and change in perceived teacher support for both of the math value scales (INT, $F = 7.45$, $p < .0001$; USE, $F = 3.64$, $p < .05$). Thus the rate of change within the school year in student perceptions of the intrinsic value and usefulness/importance of math is different at year one and year two depending on perceived teacher support before and after the transition. As illustrated in Figures 1 and 2, there is a particularly dramatic year by semester contrast for the two groups of students who perceive change in the student/teacher relationship after the transition (high to low perceived support and low to high perceived support). Both of these groups experience greater changes in the valuing of math during the year they have teachers who are perceived to be low in support.

To aid in the interpretation of the results, post hoc comparisons using the Scheffe method were conducted to compare each of the Change in Teacher Support groups to each of the other groups in order to determine if they differed significantly from each other in regard to year changes in the dependent variables. As was true with the MANOVA, year effects compared the combined means in each dependent variable at waves 1 and 2 to those

at waves 3 and 4. Because the alpha reflects the error rate for the entire set of contrasts, this technique provides a conservative estimate of effects. Using a .95 confidence level, there were significant differences in the cross year intrinsic valuing of math for five of the six comparisons. The exception was the lack of difference year one and year two in intrinsic value for students who had teachers perceived to be low in support both years and those moving from teachers perceived to be high in support to teachers perceived to be low in support. The reason for this, as illustrated by Figure 1, is that low perceived teacher support seems to have a particularly strong impact during the junior high school year and both of these groups have teachers perceived to be low in support year two.

Looking at student perceptions of the importance and usefulness of math, there are four significant group comparisons. First, year changes for students moving from teachers they perceive to be more supportive to teachers they perceive to be less supportive differed from those for students moving from teachers perceived to be less supportive to those perceived to be more supportive or students who had teachers perceived to be high in support both years. Second, students who had teachers low in perceived support both years differed from students who had teachers high in perceived support both years or moved from teachers they perceived to be less supportive to those they perceived to be more supportive. Again, this reflects the particular importance of student perceptions of the student/teacher relationship in the junior high school year.

There is no interaction with student sex for any of the year or semester effects. There is, however, an interaction between student achievement and year by semester effects for student perceptions of the importance and usefulness of math ($F = 5.95$, $p < .05$). The relation of these interactions to changes in perceptions of teacher support approaches significance ($F = 2.23$, $p < .08$). Inspection of Table 1 and Figures 3 and 4 reveals that moving from teachers high in perceived support in elementary school to teachers low in perceived support in junior high school results in a steeper decline in perceptions of the usefulness and importance of math within year two for low achieving students than for high achieving students.

INSERT FIGURES 3 AND 4 ABOUT HERE

## Discussion

This study provides support for our theory that systematic changes in the nature of the classroom environment after the transition to junior high are related to developmental changes in students' academic motivation. Our hypothesis that changes in students' perceptions of the supportiveness of their teachers before and after the transition to junior high school are related to changes in their valuing of mathematics was confirmed by the

predicted interaction between school year and change in perceived teacher support pattern. These results suggest that the value of math increases for students who move from less supportive to more supportive teachers after the transition and decreases for those who experience the opposite pattern of change.

In an earlier study we found that when students make the transition to junior high school they perceive their math teachers to be less supportive than the teachers they had the previous year (Feldlaufer et al., 1988). Other studies have confirmed this negative change in student/teacher relations after the transition. In light of these studies, our results take on special meaning. If moving to less supportive teachers is associated with a deterioration in the valuing of math, then an overall decline in the valuing of math in association with the transition is predictable. In fact, we find a year decline in the valuing of math. Of particular importance, we find that changes in the perceived student/teacher relationship contribute to this decline However, we see that for children who move to teachers who are perceived to be more supportive after the transition, there is a facilitative effect on their valuing of math. Thus, it is not inevitable that children suffer a decline in their valuing of mathematics when they make the junior high school transition, rather classroom environment factors, such as the quality of the student/teacher relationship, influence their beliefs.

Some researchers interested in the effects of the transition to junior high school have assumed that movement to a new school environment during early adolescence is inevitably traumatic for many children. Simmons and others believe that the transition to a new school would be less damaging if it did not occur when children were also undergoing the physiological and psychological changes associated with puberty (e.g., Simmons, Blyth, Van Cleave, & Bush, 1979). Although we believe that the timing of the transition makes early adolescents particularly vulnerable, this study shows that they are vulnerable to both positive and negative influences. We suggest that less attention needs to be paid to the timing of the transition to junior high school and more attention needs to be paid to the nature of the junior high school classroom environment. If, as this study suggests, a deterioration in the student/teacher relationship when students move to the junior high has a negative effect on their motivation and values in math, then more attention should be paid to providing an environment in which teacher support of students can flourish.

It is possible, of course, that the association we found reflects the impact of students' beliefs on their perceptions of their teachers' characteristics. In studies that are not "true" experiments, it is very difficult to establish the causal direction of influence. Our results, using a quasi-experimental design, suggest that there may be a causal relationship between changes in perceived teacher support and changes in the valuing of math. However, it is

possible that children who are becoming more negative toward school and subject matter perceive their teachers as less warm than those they had the previous year and children who are becoming more positive toward school see their junior high teachers as more supportive than their elementary teachers. Subsequent research using independent ratings of teacher support will be necessary to distinguish between these two alternatives.

These data indicate that the perceived student/teacher relationship is more powerful in affecting students' intrinsic value in math during the first year of junior high school than during the last year of elementary school. Similarly, Berndt and Hawkins (1988) found a stronger relationship between perceived teacher support and perceived cognitive competence after the transition than before. The quality of the student/teacher relationship may have an especially powerful effect as children move into adolescence. Psychiatrists have suggested that positive relationships with teachers are particularly important during adolescence, when children are developing an identity outside the family group and are looking for extra-parental adult models (e.g., Miller, 1970, 1974; Offer, 1969). Miller believes that the organization of the traditional junior high school inhibits the development of warm, stable human interactions. Thus when the need for positive relationships with adults outside the home is particularly strong, the likelihood that schools will provide these positive human contacts is particularly low.

Does the departmentalized organization of the junior high school inhibit the development of positive teacher/student relationships? McPartland (1987) found that sixth-grade student/teacher relations were more positive in schools that assigned teachers to self-contained classrooms than in schools where departmentalized staffing was used. In our study all the junior high schools were departmentalized but not all the children experienced a negative change in student/teacher relations; thus other factors must be important as well. We need to find out more about the conditions that enable some junior high schools and some junior high school teachers to maintain a warm, friendly, supportive relationship with their students. How do methods of teacher recruitment or training influence the teacher/student relationship? Is school size a factor? There is some evidence that larger schools may provide less positive environments than smaller schools, especially for vulnerable or marginal children (Barker & Gump, 1964). We have suggested elsewhere (Midgley et al., in press) that stereotypes about early adolescents may flourish in some middle level schools, undermining the student/teacher relationship. Epstein and McPartland (1976), using survey data from students in elementary, middle, and high schools, found a positive relation between students' perceived quality of student-teacher relations (one of three dimensions measured by the Quality of School Life Scale - QSL) and the openness of the school authority structure. The school authority structure did not have

a similar relationship with the other dimensions of the QSL. That is, school openness in terms of either variety of activities, individualization, or students' share of responsibility had its greatest impact on reactions to teachers, rather than on general satisfaction with school or commitment to classwork. In the study by Berndt and Hawkins (1988), students who moved to a traditional junior high school perceived their teachers as less supportive after the school transition than before, while students who moved to a team-taught, less traditional junior high school perceived their teachers as equally supportive before and after the transition. Additional studies are needed that will help us determine which of these factors are most potent in affecting the teacher-student relationship during the early adolescent years. Hopefully these data will be used to design a more responsive educational environment for this age group.

The hypothesis that the impact of changes in the student/teacher relationship on students' values in math is stronger for girls than for boys was not confirmed. Although it has been suggested that girls are more sensitive to social approval than are boys (Dweck & Bush, 1976; Maehr & Nicholls, 1980), the student/teacher relationship involves more than approval and disapproval. Both boys and girls appear to be affected by the perceived warmth, friendliness, and fairness of their teachers.

Although there was no interaction with student achievement level for student perceptions of the intrinsic value of math, the negative effect during the junior high school year on low achieving students' beliefs about the importance and usefulness of math is noteworthy. Task value has been shown to be an important predictor of children's task choices (Crandall, 1969; Crandall, Katkovsky, & Preston, 1962) and task persistence (Battle, 1965, 1966; Eccles et al., 1984; Stein & Bailey, 1973). If the value of math decreases for many low achieving students when they move to the junior high school environment, they may be especially likely to give up trying to achieve in math and to drop it entirely when it becomes an elective.

It should be pointed out that this study deals with only one subject matter area - mathematics. Because junior high schools are usually departmentalized, studies comparing elementary and junior high school classrooms are frequently subject specific. Other studies are needed that look at similar variables in other subject matter areas.

A number of investigators are currently examining the effect of the transition to junior high school on early adolescent development. Relatively little attention has been focused on the effect of changes in the classroom environment on adolescent adjustment. We believe this study points to the importance of including teacher and classroom variables in these studies.

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## Footnotes

[1] Most of the students excluded from this study were from two school districts where policy changed during the course of data collection so that some students did not move to a new school.

[2] Detailed information about the construction of these scales, including factor analysis procedures and assessment of reliability, can be found in Feldlaufer et al., in press.

[3] Year one the mean on the Teacher Support scale was 1.7 and year two the mean was 1.8. To create the Change in Teacher Support variable, scores from 1 to 1.8 on the Teacher Support scale were categorized as high perceived teacher support and scores above that were categorized as low perceived teacher support. Using this criteria, 607 students were categorized as having teachers high in perceived support both before and after the transition (waves 2 and 4), 230 had teachers low in perceived support both years, 274 students moved from teachers high in perceived support to teachers low in perceived support, and 190 moved from teachers low in perceived support to teachers high in perceived support.

Table 1

Means and Standard Deviations of Students' Valuing of Mathematics

| Change in Teacher Support | n | Intrinsic Value in Mathematics | | | | Importance/ Usefulness of Mathematics | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 |
| **All Students** | | | | | | | | | |
| High/High | 607 | 4.16 | 4.18 | 4.07 | 3.94 | 6.30 | 6.27 | 6.09 | 6.02 |
| | | 1.09 | 1.10 | 1.02 | 1.09 | .82 | .85 | .98 | 1.02 |
| High/Low | 274 | 3.86 | 3.85 | 3.42 | 3.04 | 6.13 | 6.07 | 5.63 | 5.35 |
| | | 1.21 | 1.27 | 1.20 | 1.21 | .97 | .99 | 1.19 | 1.33 |
| Low/High | 190 | 3.82 | 3.59 | 3.86 | 3.80 | 6.09 | 5.92 | 5.89 | 5.88 |
| | | 1.19 | 1.28 | 1.13 | 1.20 | .90 | 1.09 | 1.12 | 1.11 |
| Low/Low | 230 | 3.59 | 3.34 | 3.14 | 2.93 | 5.88 | 5.62 | 5.40 | 5.08 |
| | | 1.24 | 1.24 | 1.19 | 1.23 | 1.13 | 1.27 | 1.31 | 1.43 |
| All | 1301 | 3.95 | 3.87 | 3.74 | 3.55 | 6.16 | 6.06 | 5.84 | 5.70 |
| | | 1.18 | 1.23 | 1.16 | 1.24 | .94 | 1.03 | 1.14 | 1.24 |
| **Low Achieving Students** | | | | | | | | | |
| High/High | 127 | 4.01 | 4.00 | 3.88 | 3.71 | 6.11 | 6.11 | 5.93 | 5.89 |
| | | 1.21 | 1.21 | 1.11 | 1.23 | 1.02 | 1.00 | 1.17 | 1.12 |
| High/Low | 71 | 3.64 | 3.70 | 3.25 | 2.71 | 5.86 | 5.89 | 5.44 | 4.82 |
| | | 1.38 | 1.34 | 1.20 | 1.26 | 1.13 | 1.17 | 1.34 | 1.57 |
| Low/High | 53 | 3.73 | 3.40 | 3.75 | 3.63 | 5.88 | 5.83 | 5.76 | 5.68 |
| | | 1.38 | 1.12 | 1.13 | 1.32 | 1.07 | 1.21 | 1.33 | 1.14 |
| Low/Low | 72 | 3.40 | 3.25 | 3.10 | 2.97 | 5.54 | 5.39 | 5.13 | 4.87 |
| | | 1.26 | 1.17 | 1.13 | 1.27 | 1.24 | 1.32 | 1.38 | 1.47 |
| All | 323 | 3.75 | 3.67 | 3.55 | 3.31 | 5.89 | 5.86 | 5.62 | 5.39 |
| | | 1.30 | 1.25 | 1.18 | 1.33 | 1.12 | 1.17 | 1.32 | 1.40 |

Table 1 (Continued)

| | | High Achieving Students | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| High/High | 480 | 4.20 | 4.23 | 4.12 | 4.00 | 6.35 | 6.31 | 6.13 | 6.06 |
| | | 1.06 | 1.07 | .99 | 1.05 | .76 | .80 | .92 | .99 |
| High/Low | 203 | 3.94 | 3.90 | 3.48 | 3.15 | 6.22 | 6.13 | 5.70 | 5.54 |
| | | 1.14 | 1.25 | 1.19 | 1.18 | .89 | .91 | 1.13 | 1.18 |
| Low/High | 137 | 3.86 | 3.66 | 3.90 | 3.87 | 6.17 | 5.95 | 5.94 | 5.95 |
| | | 1.12 | 1.33 | 1.14 | 1.14 | .81 | 1.04 | 1.03 | 1.10 |
| Low/Low | 158 | 3.68 | 3.38 | 3.15 | 2.92 | 6.04 | 5.73 | 5.52 | 5.18 |
| | | 1.23 | 1.27 | 1.22 | 1.22 | 1.05 | 1.24 | 1.27 | 1.41 |
| All | 978 | 4.01 | 3.94 | 3.80 | 3.62 | 6.24 | 6.13 | 5.91 | 5.79 |
| | | 1.13 | 1.22 | 1.15 | 1.20 | .85 | .97 | 1.07 | 1.17 |

Note. Cells display means (above) and standard deviations (below). W1=Wave 1, W2=Wave 2, W3=Wave 3, W4=Wave 4

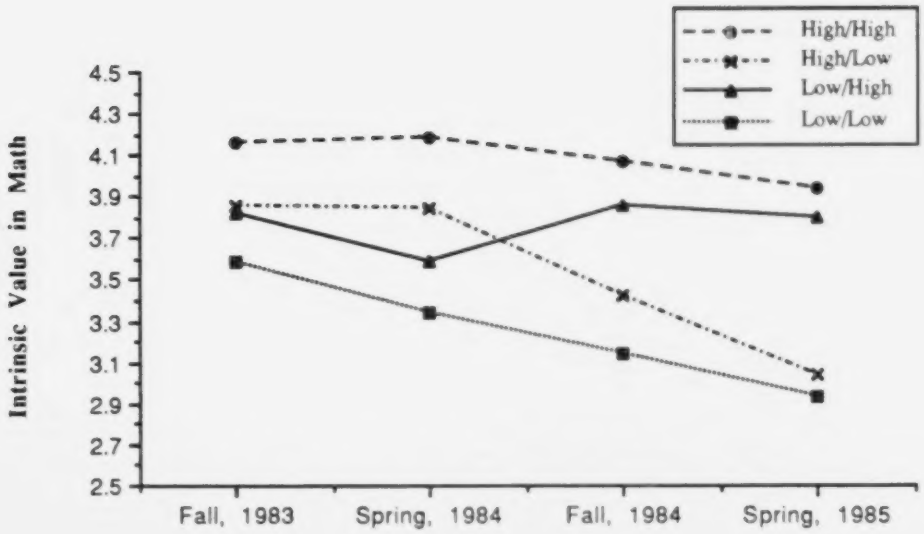
## Figure Captions

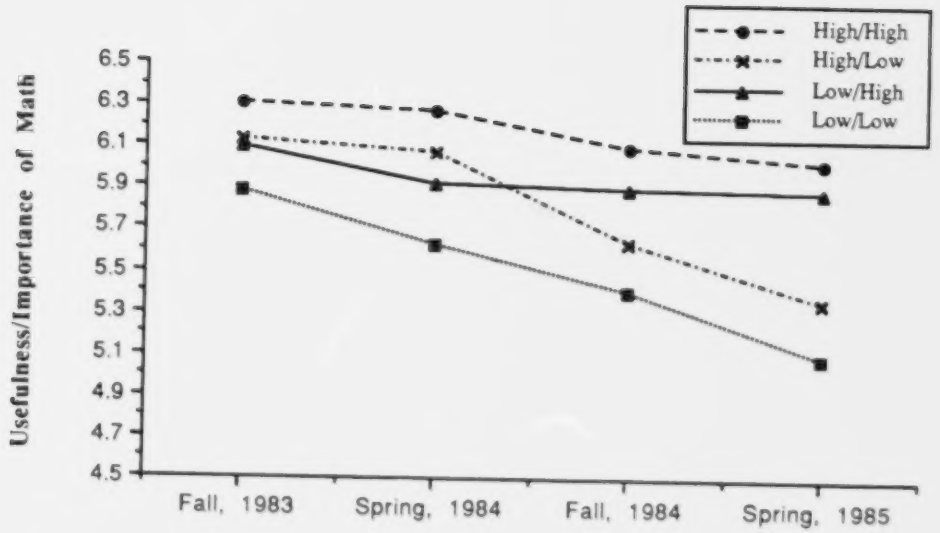
FIG. 1.-Intrinsic value in math and change in teacher support

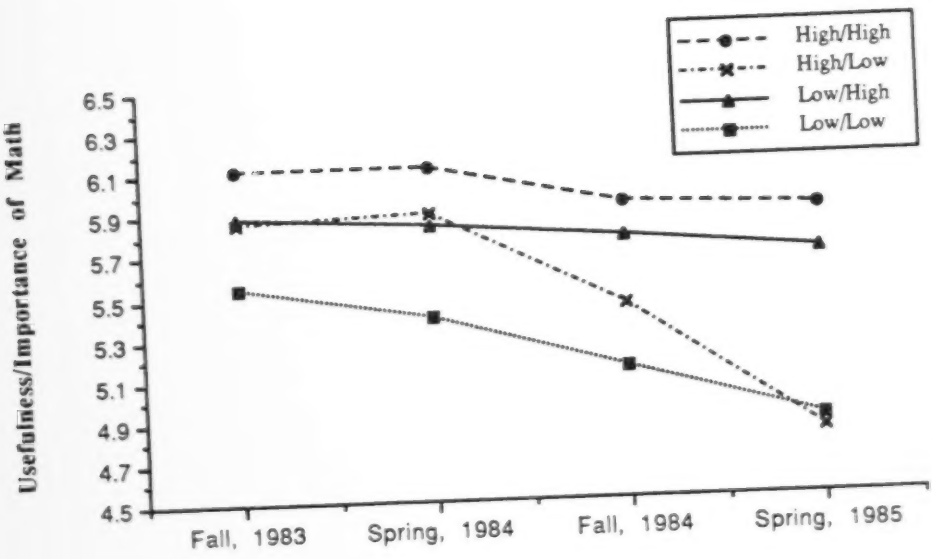
FIG. 2.-Perceived usefulness/importance of math and change in teacher support

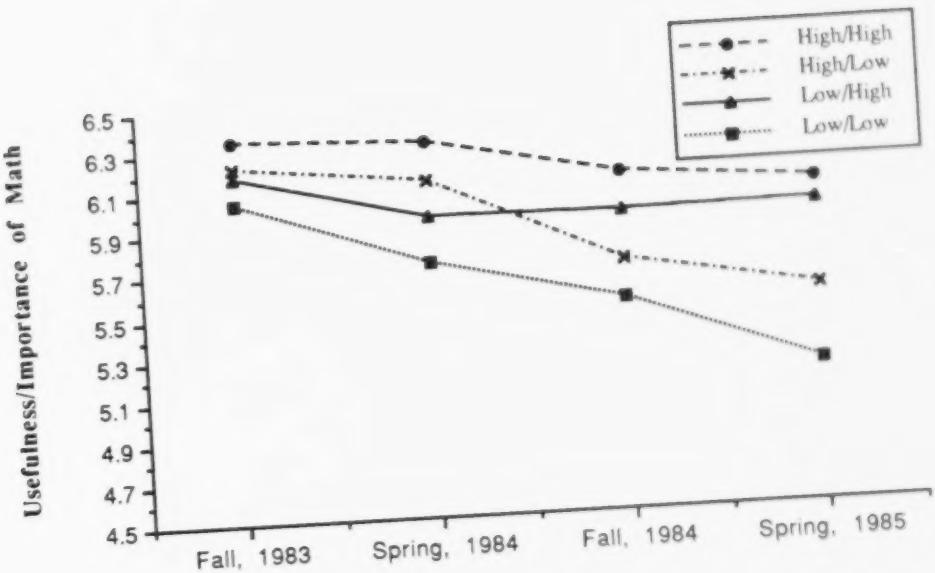
FIG. 3.-Perceived usefulness/importance of math and change in teacher support for low achieving students

FIG. 4.-Perceived usefulness/importance of math and change in teacher support for high achieving students


High/High
High/Low
Low/High
Low/Low
Intrinsic Value in Math
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
2.9
2.7
2.5
Fall, 1983
Spring, 1984
Fall, 1984
Spring, 1985


High/High
High/Low
Low/High
Low/Low
Usefulness/Importance of Math
6.5
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
Fall, 1983
Spring, 1984
Fall, 1984
Spring, 1985


High/High
High/Low
Low/High
Low/Low
Usefulness/Importance of Math
6.5
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
Fall, 1983
Spring, 1984
Fall, 1984
Spring, 1985


High/High
High/Low
Low/High
Low/Low
Usefulness/Importance of Math
6.5
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
Fall, 1983
Spring, 1984
Fall, 1984
Spring, 1985

## Appendix

### Measures of the Teacher-Student Relationship and Student Valuing of Mathematics

*Teacher Support*

The teacher cares how we feel. (R*)
The teacher is friendly to us. (R)
The teacher treats boys and girls differently.
The teacher grades our math work fairly. (R)
The teacher treats some kids better than other kids.
The teacher criticizes us when we do poor work.
<1> Not very often <2> Sometimes <3> Usually <4> Very often

*Intrinsic Value of Mathematics*

In general, I find working on math assignments
<1> Very boring -- <7> Very interesting

How much do you like doing math?
<1> A little -- <7> A lot

Do you spend as much time as you do in math
<1> Because you have to in order to in order to finish the work?
<2>Because you just like doing math?

Would you take more math <u>if you didn't have to</u>?
<1> I very definitely would take more math.
<2) I probably would take more math.
<3> Maybe I would take more math.
<4> I'm not sure.
<5> Maybe, but not that likely.
<6> I probably would not take any more math.
<7> I very definitely would not take any more math.

*Importance and Usefulness of Math*

For me, being good at math is
<1> Not at all important -- <7> Very important

In general, how useful is what you learn in math?
How useful do you think the math you are learning will be for what you want to do after you graduate and go to work?
How useful do you think high school math will be for what you want to do after you graduate and go to work?
<1> Not at all useful -- <7> Very useful

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*Scoring of these items was reversed to create the scale. Low scores = high teacher support.